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Comparative Studies on the Fecundity and Longevity of *Neochetina eichhorniae* and *N. bruchi*, Potential Biocontrol Agents of Water Hyacinth

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ABSTRACT

Neochetina eichhorniae Warner and *N. bruchi* Hustache (Coleoptera : Curculionidae), of South American origin, were introduced into India for biological control of water hyacinth. Laboratory studies on fecundity and longevity showed that *N. eichhorniae* females lived for 142.2 days (range 32-207) and laid 891 eggs (range 150-1254) while *N. bruchi* laid 681.6 eggs (range 303-918) in 134.2 days (range 59-175). The maximum mean daily egg production per female was 14.2 on the 16th day after emergence in the case of *N. eichhorniae* and 17.4 on the 14th day in *N. bruchi*. *N. eichhorniae and N. bruchi* laid 50% of their eggs by the 9th week, 75% by the 17th and 14th weeks respectively and 90% by the 22nd and 18th weeks respectively.

Key words : Water hyacinth, *Eichhornia crassipes*, weed killers, *Neochetina eichhorniae*, *N. bruchi*, fecundity, longeity

The water hyacinth, *Eichhornia crassipes* which was spread by man as an ornamental plant is now established as a serious problem weed in many countries. With an estimated coverage of 200,000 ha of water surface (Anon., 1979), the water hyacinth is considered to be the most serious aquatic weed in India. As part of an effort to bring about biological control of this weed, two species of weevils, *Neochetina eichhorniae* Warner and *N. bruchi* Hustache were introduced into India in 1982 under the All India coordinated research project on biological control of crop pests and weeds. Field releases with *N. eichhorniae* initiated in March 1983 after host-specificity tests under quarantine conditions conclusively proved its safety to cultivated crops (Nagarkatti and Jayanth, 1984). Suppression and control of water hyacinth by release of *N. eichhorniae* has already been reported (Jayanth, 1987 a, b). *N. bruchi* was also found to be specific to water hyacinth (Jayanth and Nagarkatti, 1987) and encouraging results are now being obtained after field releases were initiated in Bangalore in February 1984.

Although the biology of *N. eichhorniae* and *N. bruchi* was studied by many authors (Warner, 1970; DeLoach and Cordo, 1976 a, b; Stark and Goyer, 1983), detailed information on the fecundity of the weevils

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is lacking. The present paper reports results of detailed studies with the weevils after preliminary trials had indicated that they are more fecund than reported earlier.

MATERIALS AND METHODS

The study was carried out using 5 pairs of freshly emerged adults each of *N. eichhorniae* and *N. bruchi*. Individual pairs were released in separate plastic jars (6.5 x 6 cm.) with wire-mesh windows on the lids for aeration. A water hyacinth leaf with the edges of the lamina clipped off and retaining only 2 cm of its petiole was introduced into each jar with 1 cm layer of water at the bottom. The exposed leaves were removed every day and fresh ones introduced. The collected leaves were then dissected out under a binocular stereo-microscope and the number of eggs counted. The process was repeated until the adults died.

Every week, about 25 eggs each of *N. eichhorniae* and *N. bruchi* were kept for hatching on a moist filter paper in a Petridish and percentage of hatching was worked out. The mortalities of the adults were recorded from which their longevity was calculated. The studies were carried out under laboratory conditions at 30 ± 4°C.

RESULTS AND DISCUSSION

Adults of *N. eichhorniae and N. bruchi* were observed to mate periodically throughout their life. Females laid their eggs beneath the epidermis of water hyacinth leaves after making holes with their mandibles. Eggs were occasionally found deposited on the leaf surface or in the container under laboratory conditions. Females of *N. eichhorniae* lived for 32-207 days (mean 142.2) and laid 150-1254 eggs (mean 891). In the case of *N bruchi*, the females survived for 59-175 days (mean 681.6). Males of both *N eichhorniae* and *N. bruchi* were observed to survive longer than the females with a mean of 170.4 and 180.8 days, respectively.

The fecundity of *N. bruchi* observed in the present study (681.6±345.2), which is 566% more than the 102.3 ± 82.0 reported by DeLoach and Cordo (1976a) in its native home in Argentina, is quite significant. Previous studies had indicated that *N. bruchi* laid more number of eggs than *N. eichhorniae* (DeLoach and Cordo, 1976a, b; Stark and Goyer, 1983; Harley, 1984). However, in the present study, *N. eichhorniae* was observed to lay 20.72% more number of eggs when compared to *N. bruchi*. It was reported by DeLoach and Cordo (1976a) that at cooler temperatures, *N. bruchi* fed and oviposited more than *N. eichhorniae*. As the studies in Argentina were carried out at 25°C as against 30 ± 4° at Bangalore, the increased oviposition by *N. eichhorniae* as compared with *N. bruchi* observed here, could be due to the influence of temperature.

Observations on the age-specific fecundity of the weevils showed that the preoviposition periods of the weevils were 5-7 days for *N. eichhorniae* and 4-6 days for *N. bruchi*. Peak oviposition by *N. eichhorniae* was observed on the 16th day after emergence with a mean daily egg production of 14.2. However, females were found capable of laying upto 28

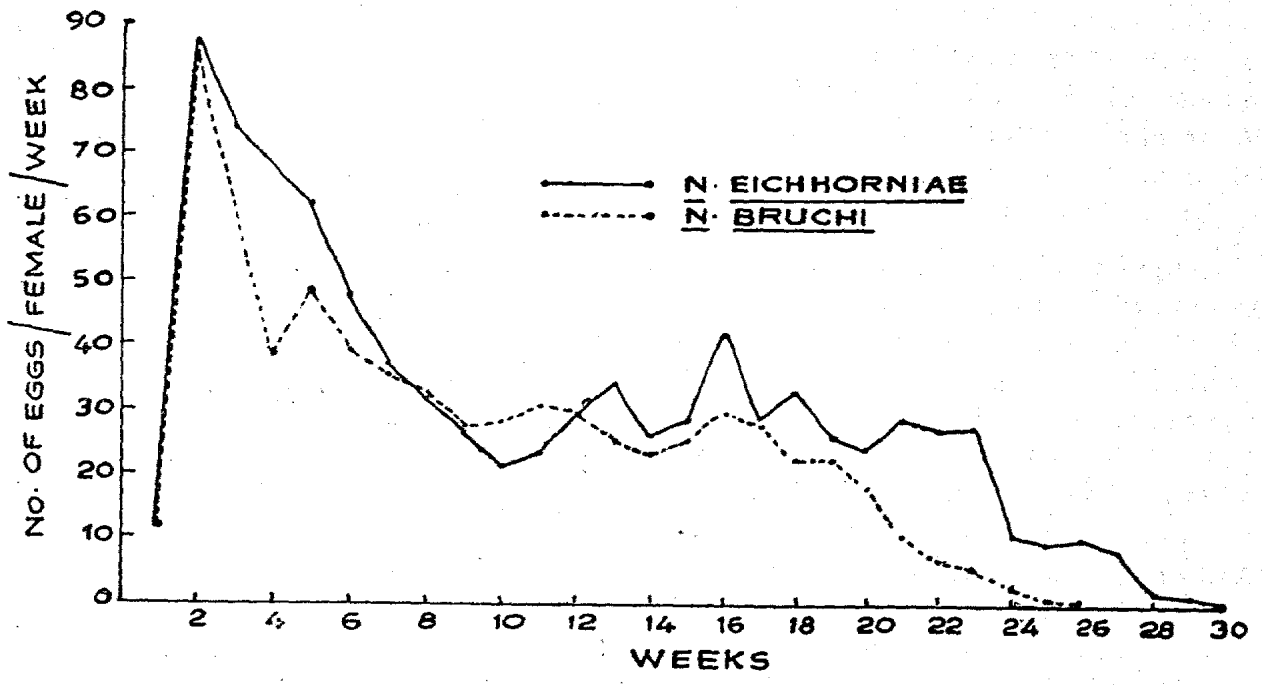

Fig. 1, Age-specific weekly egg production of *N. eichhorniae* and *N. bruchi*

eggs per day. In the case of *N. bruchi*, the maximum number of eggs produced by a single female was 27 and the mean daily egg production peaked at 17.4 on the 14th day. The Maximum egg production figures in Argentina were 7.3 and 8.5 per female per day respectively for *N. eichhorniae and N. bruchi* (DeLoach and Cordo, 1976a).

The age specific weekly egg production data is summarised in Fig. 1. Females of *N. eichhorniae* laid between 61.8 to 87.8 eggs per female per week from the 2nd to 5th week with the peak egg production during the 2nd week. Egg production remained above 20 upto the 23rd week and declined thereafter. *N. bruchi* laid more eggs during the 2nd and 3rd weeks when 86 and 61 eggs could be collected per female. Between the 4th and 19th weeks, egg production remained above 20 per female.

It was observed that 50% of the total complement of eggs were laid by *N. eichhorniae* by the 9th week, 75% by the 17th week and 90% by the 22nd week although adults lived for upto 30 weeks. Similarly, *N. bruchi* females were also found to lay 50% of their eggs by the 9th week although 75 and 90% oviposition were completed by the 14th and 18th week respectively. Earlier reports had indicated that the weevils laid 90% of their eggs within a month after emergence although they lived for over 9 months (Center and Balciunas, 1982).

More than 90% of the eggs laid during the first 6 weeks in the case of *N. eichhorniae* and 4 weeks in the case of *N. bruchi*, were observed to

hatch. Between 70 to 80% hatching was noticed upto 23rd and 17th weeks respectively for *N. eichhorniae* and *N. bruchi*. Hatching remained below 20 percent during the last 4 weeks in the life of the weevils.

Significant increase was also observed in the longevity of the weevils in the present study when compared with earlier studies under laboratory conditions. As against 57.8 ± 9.6 days (Stark and Goyer, 1983) and 47.1 ± 20.8 days (DeLoach and Cordo, 1976a) reported for *N. eichhorniae* and *N. bruchi* respectively, 142.2 ± 66.7 and 134.2 ± 44.2 days longevity were observed in the present study. However, Perkins (1973) had recorded survival for 3 to 4 months and Center and Balciunas (1982) had reported that the weevils survived for upto 2 months.

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